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C.S.L. Ommanney

Hydrological Sciences Division
National Hydrology Research Institute
Environment Canada
Saskatoon, Saskatchewan
S7N 3H5

GLACIERS IN CANADA REFERENCES (1988-1990) AND RECENT WORK

NHRI Contribution No.90051

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MANAGEMENT PERSPECTIVE

The establishment of a national or international focus for hydrology at the National Hydrology Research Institute means that staff there accept positions with national and international bodies. One appropriate activity is that of Canadian national correspondent for one of the commissions of the International Association of Hydrological Sciences. Simon Ommanney is the National Correspondent for the International Commission on Snow and Ice. One of his roles is to prepare an annual report on snow and ice research in Canada for publication in the Canadian Geophysical Bulletin. This report contains a bibliography and other background information for the 1989 report (CS-90054).

PERSPECTIVE DE GESTION

L'établissement à l'Institut national de recherche en hydrologie d'un groupe national ou international de recherche spécialisée en hydrologie signifie que les employés de l'Institut sont prêts à accepter des postes dans des organismes nationaux ou internationaux. Une activité appropriée est celle du correspondant canadien pour l'une des commissions de l'Association internationale des sciences hydrologiques. Simon Ommanney est le correspondant national pour la Commission internationale de la neige et de la glace. L'un de ses rôles consiste à préparer un rapport annuel sur la recherche en matière de neige et de glace au Canada pour publication dans le Bulletin canadien de géophysique. Le présent rapport contien une bibliographie et des renseignements supplémentaires pour celui de 1989 (CS-90054).

FOREWORD

As Executive Secretary of the NRCC Subcommittee on Glaciers, and Canadian Correspondent to the International Commission on Snow and Ice (ICSI), C.S.L. Ommanney is responsible for disseminating information on Canadian glaciers. This report summarises references to work done in Canada, on Canadian glaciers and by Canadian glaciologists; published between 1988 and 1990. It is a companion to NHRI Contribution No.89001 which covered the period from 1986 to 1988. The listing includes unpublished reports and newspaper articles. The scientific articles reflect the activity of university, government and private sector scientists in different parts of the country. It is worth noting the number of non-Canadian articles using data from the National Hydrology Research Institute's glacier mass balance programs. Records from Peyto, Sentinel and Place Glaciers are now one of the longer time series available and becoming increasingly valuable in relation to assessments of global climate change.

There are several references to the Hubbard Glacier because its advance dammed a fiord and received a lot of public attention. This glacier rises in Canada. Several of the articles in the popular press deal with the commercial exploitation of glaciers for ice cubes, bottled water and water for export.

As this is only a preliminary listing, readers are asked to advise the compiler of any errors or omissions. Many of the references have not been verified and some of these may not in fact deal with Canadian glaciers.

The Appendix contains copies of the data sheets submitted to the ICSI Correspondent from glaciologists across Canada, in response to a request from the Associate Committee of Hydrology for input to the Canadian Geophysical Bulletin. These sheets have information on completed, current and future work together with contact names and numbers.

As background information for the ICSI report, other companion reports have been prepared on Snow (CS-90050), Floating Ice (CS-90052) and Permafrost (CS-90053). These are available on request from the National Hydrology Research Institute.

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WOOLER, A.R. and J.M. REYNOLDS, 1990. High frequency seismic reflection experiments on an ice island in the Canadian Arctic. Abstracts, 14th U.K. Geophysical Assembly, 18-20 April 1990, Plymouth, U.K., Geophysical Journal International, 101(1), 194

YOUNG, G.J., 1990. Glacier hydrology. In - Northern Hydrology: Canadian Perspectives, T.D. Prowse and C.S.L. Ommanney (Editors), NHRI Science Report No.1, National Hydrology Research Institute, Environment Canada, Saskatoon, Saskatchevan, 135-162

YOUNG, K.L., 1988. A study of the hydrology of a perennial snowbank in the continuous permafrost zone, south-east Melville Island, N.W.T. M.Sc. thesis, Department of Geography, University of Toronto, Toronto, Ontario, 158 pp.

YOUNG, K.L. and A.G. LEWKOVICZ, 1988. Measurement of outflow from a snowbank with basal ice. Journal of Glaciology, 34(118), 358-362

APPENDIX

CURRENT GLACIER RESEARCH

Organization and Address	Tel.No.
Department of Geophysics and Astronomy, Univ. of British Columbia, Vancouver, B.C., V6T 1W5	604-228-2267
Department/Branch Geophysics and Astronomy	**FAX No.** 604-228-6047

Researchers

E.W. Blake and G.K.C. Clarke

Project Title	Status
Subglacial Electrical Phenomena Beneath a Surge-Type Glacier	**New** [ ] **Ongoing** [X] **Completed** [ ]

Objectives Changes in the water content and water flow patterns of subglacial till can be measured using d.c. resistivity and streaming potential methods when the electrodes are placed at the ice-bed interface.

Methods
Lab [ ] **Field** [X] **Modelling** [ ] **Others**

Findings

Close correlation between subglacial water pressure and streaming potentials during pressure pulse events has been observed. Both gradual and abrupt changes in resistivity of subglacial material has been observed.

Publications

Organization and Address	Tel.No.
Department of Geophysics and Astronomy, Univ. of British Columbia, Vancouver, B.C., V6T 1W5	604-228-2267
Department/Branch Geophysics and Astronomy	**FAX No.** 604-228-6047

Researchers

E.W. Blake, G.K.C. Clarke and M.C. Gérin

Project Title	Status	
Bed Deformation Beneath a Surge-Type Glacier	**New**	[ ]
	Ongoing	[X]
	Completed	[ ]

Objectives

We are making in-situ measurements of bed deformation beneath Trapridge Glacier to gather data for rheological modelling of basal sediments.

Methods

Lab [ ] **Field** [X] **Modelling** [X] **Others**

Findings

Although mean basal strain rates are consistent with glacier flow velocities, the strain rate can fluctuate over a range of ±1000/yr within hours. The negative strain rates are evidence for extrusive flow within the soft bed.

Publications

Blake, E.W., G.K.C. Clarke and M.C. Gérin, 1990. Tools for in-situ examination of bed deformation. Submitted to Journal of Glaciology, April

Organization and Address	Tel.No.
National Hydrology Research Institute, 11, Innovation Blvd, Saskatoon, Saskatchewan, S7N 3H5	306-975-5749
Department/Branch Hydrological Sciences Division	**FAX No.** 306-975-5143

Researchers

M. Brugman

Project Title	Status
Mountain Hydrology and Glacial Meltwater	**New** [ ] **Ongoing** [X] **Completed** [ ]

Objectives

Develop comprehensive, long-term research programme of glacier hydrology. Review impact of mining activity by the Ice Age Company on Cline Glacier

Methods

Lab [X] **Field** [X] **Modelling** [X] **Others**

Findings

A research strategy for future mountain hydrology studies was developed and forms the basis for activities in 1990. The assessment of the ice mining activity at Cline Glacier concluded there would be little impact on the mass balance.

Publications

Brugman, M.M., 1989. Mining glaciers on Mount Cline, Alberta; an assessment. NHRI Contribution No.89054, Hydrology Division, National Hydrology Research Institute, Environment Canada, Saskatoon, Saskatchewan, 25 pp.

Brugman, M.M., 1989. Glacier length variations and climate change: comparative glacier dynamics since 1850 in the Pacific Northwest, U.S.A. Proceedings of the Symposium on Ice and Climate, 21-25 August 1989, Seattle, Washington, Annals of Glaciology, Vol.14, abstract, 332 [CS-89057]

Brugman, M.M. and C.S.L. Ommanney, 1989. Mining a glacier for fancy ice. AGU 1989 Fall Meeting, 4-8 December 1989, San Francisco, California, EOS, Transactions, American Geophysical Union, 70(43), 24 October, abstract, 1085

Organization and Address	Tel.No.
National Hydrology Research Institute, 11, Innovation Blvd, Saskatoon, Saskatchevan, S7N 3H5	306-975-5749
Department/Branch Hydrological Sciences Division	**FAX No.** 306-975-5143

Researchers

M.N. Demuth and G. Holdsworth

Project Title	Status	
Eclipse - CRR Drill Evaluation	New	[ ]
	Ongoing	[X]
	Completed	[ ]

Objectives

Perform full-scale field testing of the Canadian-Rufli-Rand Ice Core Drill by occupying Eclipse station in the Icefield Ranges of the St. Elias (Y.T.)

Methods

Lab [X] **Field** [X] **Modelling** [ ] **Others**

Findings

A full-scale field test of the Canadian-Rufli-Rand Ice Core Drill was successfully completed at the Eclipse station. The drill is nov stored at AINA Kluane Lake Research Station until further notice regarding the future of coring operations in the Saint Elias Mountains.

Publications

Organization and Address	Tel.No.
National Hydrology Research Institute, 11, Innovation Blvd, Saskatoon, Saskatchewan, S7N 3H5	306-975-5749
Department/Branch Hydrological Sciences Division	**FAX No.** 306-975-5143

Researchers

M.N. Demuth and J. Schmok (see report by Schmok and Clarke)

Project Title	Status	
Coast Mountain Glaciers	New	[ ]
	Ongoing	[X]
	Completed	[ ]

Objectives

To determine the mass balance of Place, Sentinel and Helm Glaciers and document terminal and surficial movement.

Methods

Lab [ ] **Field** [X] **Modelling** [ ] **Others**

Findings

The mass balances of Place, Sentinel and Helm Glaciers were determined. As in most previous years, the balances appear to be negative and the glaciers continue to retreat. Suspicions exist about the previous values determined for the mass balance of Sentinel Glacier and steps are being taken to verify the earlier data.

Publications

Schmok, J., 1990. Mass balance, geodetic and photographic surveys of Sentinel, Place and Helm Glaciers: 1989 balance year. NHRI Contract Report No.90001, Contract No.KW504-0062/01-XSB, Department of Geophysics and Astronomy, University of British Columbia, Vancouver, B.C. for the Physical Hydrology Division, National Hydrology Research Institute, Environment Canada, Saskatoon, Saskatchewan, 29 pp.

Organization and Address Terrain Sciences Division, Geological Survey of Canada, 601 Booth Street, Ottawa, Ontario, K1A 0E8	**Tel.No.** 613-998-7623
Department/Branch Glaciology Section	**FAX No.** 613-996-9990

Researchers

D. Fisher, R.M. Koerner, B. Alt and J. Bourgeois

Project Title **Glaciology Paleoclimate, Recent Climate**	**Status** **New** [ ] **Ongoing** [X] **Completed** [ ]

Objectives

Research in past changes and future trends.

Methods
Lab [X] **Field** [X] **Modelling** [X] **Others**

Findings

Paleo variables from ice caps through ~100 ka, temperature, air chemistry, melt layers, pollen rheology, etc.

Publications

Organization and Address	Tel.No.
National Hydrology Research Institute, 11, Innovation Blvd, Saskatoon, Saskatchewan, S7N 3H5	306-975-5749
Department/Branch Hydrological Sciences Division	**FAX No.** 306-975-5143

Researchers

S. Fogarasi, B. McCarthy and G. Holdsworth

Project Title	Status	
Proxy Climate Data from Ice Cores	New	[ ]
	Ongoing	[X]
	Completed	[ ]

Objectives

To use pressure, temperature, upper air wind and precipitation data sets from continental and marine stations and to decipher the Mt. Logan ice core results

Methods

Lab [X] **Field** [X] **Modelling** [X] **Others**

Findings

Upper air data was processed to obtain mean monthly wind direction and speed for Yakutat and Whitehorse for 1965 and 1986. A paper on the tropospheric structural interpretation of vertical stable isotopic profiles derived from snow pits in the St. Elias Mountains, Yukon is under review.

Publications

Holdsworth, G. and S. Fogarasi, 1988. Investigation of atmospheric structure in the Mt. Logan region using upper air data from three radio-sonde stations. Draft (being reviewed). [CS-88086]

Holdsworth, G., S. Fogarasi and H.R. Krouse, 1988. Tropospheric structural interpretation of vertical stable isotope profiles derived from snow pits in the St. Elias Mountains, Yukon. Journal of Geophysical Research, *(*), **-** [CS-88040]

Organization and Address Department of Geography, University of Waterloo, Waterloo, Ontario, N2L 3G1	Tel.No. 519-885-1211 Ext.3439
Department/Branch Geography	FAX No. 519-888-6768

Researchers

James S. Gardner

Project Title	Status	
Glacier Headwall Weathering Processes	New	[ ]
	Ongoing	[X]
	Completed	[ ]

Objectives

Monitoring of temperature and moisture conditions at the headwall of a glacier.

Methods

Lab [ ] Field [X] Modelling [ ] Others

Findings

Zonation of freeze-thav temperature regimes and moisture availability is restricted to a 2-m wide band at the snow/ice - rockwall interface.

Publications

Gardner, J., 1987. Evidence for headwall weathering zones, Boundary Glacier, Canadian Rock Mountains. Journal of Glaciology, 33(113), 60-67

Organization and Address	Tel.No.
Department of Geography, University of Waterloo, Waterloo, Ontario, N2L 3G1	519-885-1211 Ext.3439
Department/Branch Geography	**FAX No.** 519-888-6768

Researchers

James S. Gardner, E. Mattson and F.A. deScally

Project Title	Status	
Various glaciological/geomorphological studies in the Rockies, Karakorum and Himalaya	**New**	[ ]
	Ongoing	[X]
	Completed	[ ]

Objectives

Determination of the ablation under debris-covers, the impact on glacial hydrology and the hydrological implications of snow avalanches.

Methods

Lab [ ] **Field** [X] **Modelling** [ ] **Others**

Findings

- Quantification of impact of debris-cover thickness on glacial ablation.
- Method to calculate mass transport in avalanches
- Temperature index method for estimating water yield from avalanches and undisturbed snow.

Publications

Mattson, L.E. and J.S. Gardner, 1990. Energy exchanges and ablation rates on the debris-covered Rakhiot Glacier, Pakistan. Zeitschrift für Gletscherkunde und Glazialgeologie (in press)

Gardner, J.S. and K. Hewitt, 1990. A surge of Bualtar Glacier, Karakorum Range, Pakistan: a possible landslide trigger. Journal of Glaciology (in press)

de Scally, F.A. and J.S. Gardner, 1990. Ablation of avalanches and undisturbed snow, Himalaya, Pakistan. Water Resources Research (in press)

Bell, I., J.S. Gardner and F.A. de Scally, 1990. An estimate of snow avalanche erosion, Kaghan Valley, Himalaya, Pakistan. Arctic and Alpine Research (in press)

Organization and Address	Tel.No.
National Hydrology Research Institute, 11, Innovation Blvd, Saskatoon, Saskatchewan, S7N 3H5	306-975-5749
Department/Branch Hydrological Sciences Division	**FAX No.** 306-975-5143

Researchers

G. Holdsworth

Project Title	Status	
Peyto Glacier	New	[ ]
	Ongoing	[X]
	Completed	[ ]

Objectives

To continue the glacier mass balance program and to monitor subglacial stream flow.

Methods

Lab [X] **Field** [X] **Modelling** [ ] **Others**

Findings

Peyto Glacier was visited a number of times for the measurement of mass balance, in the spring (winter balance, April 26 ±), mid-summer (August 14-16), and the fall (net balance, Sept. 22-29).

The stream was gauged and a new battery installed on the data logger for Scott Munro (Nov. 1-2).

Publications

Organization and Address	Tel.No.
National Hydrology Research Institute, 11 Innovation Boulevard, Saskatoon, Saskatchewan, S7N 3H5	306-975-5749
Department/Branch Hydrological Sciences Division	**FAX No.** 306-975-5143

Researchers

G. Holdsworth, H.R. Krouse, M. Nosal and P. Mayewski

Project Title	Status	
Ice Core - Climate Change	New	[ ]
	Ongoing	[X]
	Completed	[ ]

Objectives

To extract climatic and other atmospheric signals from glacier ice cores

Methods

Lab [X] **Field** [X] **Modelling** [X] **Others** Analytical

Findings

A snow accumulation time series covering most of the last three centuries has been shown to contain potentially useful information vis-à-vis hydrology.

Publications

Holdsworth, G., H.R. Krouse, M. Nosal, M.J. Spencer and P.A. Mayewski, 1989. Analysis of a 290-year net accumulation time series from Mt. Logan, Yukon. In - Snow Cover and Glacier Variations, S.C. Colbeck (Editor), Proceedings of the Baltimore Symposium, 10-19 May 1989, Baltimore, Maryland, IAHS Publication No.183, International Association of Hydrological Sciences, 71-79

Monaghan, M.C. and G. Holdsworth, 1990. The origin of non-sea-salt sulphate in the Mount Logan ice core. Nature, 343(6255), 18 January, 245-248

Organization and Address	Tel.No.
National Hydrology Research Institute, 11 Innovation Boulevard, Saskatoon, Saskatchewan, S7N 3H5	306-975-5755
Department/Branch Hydrological Sciences Division	**FAX No.** 306-975-5143

Researchers

G. Holdsworth, G. Osborn and B.H. Luckman

Project Title	Status	
Glacier-Holocene Climate Reconstruction for Rocky Mts.	**New**	[ ]
	Ongoing	[X]
	Completed	[ ]

Objectives

To construct glacial (climatic) history for the Rocky Mountains for the Holocene period.

Methods

Lab [ ] **Field** [X] **Modelling** [ ] **Others**

Findings

Early- to mid-Neoglacial advances occurred in the eastern Rocky Mountains at several locations. Information is derived from over-ridden and preserved wood fragments.

Publications

Luckman, B.H., G. Holdsworth and G.D. Osborn, 1990. The Neoglacial period in the Canadian Rockies. Abstract for Canadian Committee on Climate Fluctuations and Man meeting, ** date **, Ottawa, Ontario, 2 pp. Proceedings, CANQUA Conference (in press) [CS-89095]

Organization and Address Department of Geography, University of Ottawa, 165 Waller, Ottawa, Ontario, K1N 6N5	**Tel.No.** 613-564-2471 or 2395
Department/Branch Geography	**FAX No.** 613-564-6529

Researchers

Peter G. Johnson, Jennifer Kasper and Glen Krusyznski

Project Title **Hydrological Regimes of Glacierized Basins**	**Status** **New** [ ] **Ongoing** [X] **Completed** [ ]

Objectives

Determination of variability of discharge and suspended sediment regimes from glaciers, moraines and talus.

Methods

Lab [X] **Field** [X] **Modelling** [ ] **Others**

Findings

The hydrological response of a glacierized basin is a function of the changes in climate from season to season. Changes froma glacier-dominated regime of high variability to a basin-dominated regime of low variability occur due mainly to the spring climatic conditions.

Publications

Kasper, J. and P.G. Johnson, 1990. Drainage of an ice-dammed lake, Kaskawulsh Glacier basin, Yukon. Proceedings, Northern Hydrology Symposium, T.D. Prowse and C.S.L. Ommanney (Editors), 10-12 July 1990, Saskatoon, Saskatchewan, NHRI Symposium No.6, National Hydrology Research Institute, Saskatoon, Saskatchewan, **-**

Kasper, J., 1989. An ice-dammed lake in the St. Elias Range, southvestern Yukon Territory: water balance, physical limnology, ice dynamics and sedimentary processes. M.A. thesis, Department of Geography, University of Ottawa, Ottawa, Ontario, 197 pp.

Organization and Address Department of Geography, University of Ottawa, 165 Waller, Ottawa, Ontario, K1N 6N5	**Tel.No.** 613-564-2471 or 2395
Department/Branch Geography	**FAX No.** 613-564-6529

Researchers

Peter G. Johnson and Glen Krusyznski

Project Title **Variability of Discharge from Alpine Glaciers**	**Status** **New** [ ] **Ongoing** [X] **Completed** [ ]

Objectives

Measure short time frame pulses in glacier discharge. Determination of internal drainage of glacier from pulse form and magnitude.

Methods

Lab [X] **Field** [X] **Modelling** [ ] **Others**

Findings

Short time frame discharge pulses occur from a combined linked-cavity/conduit glacier drainage network. These open progressively upglacier during a dry melt season and pulses vary in form due to changes in the network. Blockage and reopening, drainage of reservoirs, opening of new components of the system and drainage reorientation are the most common causes.

Publications

Johnson, P.G., 1990. Discharge Regimes of a Glacierized Basin, Slims River, Yukon. Proceedings, Northern Hydrology Symposium, T.D. Prowse and C.S.L. Ommanney (Editors), 10-12 July 1990, Saskatoon, Saskatchevan, NHRI Symposium No.6, National Hydrology Research Institute, Saskatoon, Saskatchevan, **-**

Johnson, P.G., 1990. Pulses in Glacier Discharge: Indicators of the Internal Drainage System of Glaciers. Proceedings, Northern Hydrology Symposium, T.D. Prowse and C.S.L. Ommanney (Editors), 10-12 July 1990, Saskatoon, Saskatchevan, NHRI Symposium No.6, National Hydrology Research Institute, Saskatoon, Saskatchevan, **-**

Organization and Address	Tel.No.
Department of Geography, University of Ottawa, 165 Waller, Ottawa, Ontario, K1N 6N5	613-564-2471 or 2395
Department/Branch Geography	**FAX No.** 613-564-6529

Researchers

Peter G. Johnson and Glen Krusyznski

Project Title	Status	
Suspended Sediment Dynamics in Glacier Meltwater Streams	**New**	[ ]
	Ongoing	[X]
	Completed	[ ]

Objectives

Investigate dynamics of suspended sediment variability. Determination of origin of sediment pulses within glacier.

Methods

Lab [X] **Field** [X] **Modelling** [ ] **Others**

Findings

Suspended sediment concentrations are highly variable diurnally and on a seasonal time scale. They are frequently unrelated to discharge exhibiting positive and negative hysteresis and also no relationship at all. Pulses of sediment are caused by the dynamics at the glacier bed and availability of sediment for transport.

Publications

Organization and Address	Tel.No.
Department of Geography, Saint Mary's University, Halifax, Nova Scotia, B3H 3C3	902-420-5739
Department/Branch Geography	**FAX No.** 902-420-5561

Researchers

Norman K. Jones

Project Title	Status	
Measurement of Surface Ablation and Velocity and Terminus Recession at the Boundary Glacier	**New**	[ ]
	Ongoing	[X]
	Completed	[ ]

Objectives

To ascertain the contemporary movement and ablation history of a small mountain glacier.

Methods

Lab [X] **Field** [X] **Modelling** [ ] **Others**

Findings

The Boundary Glacier is in a recessional phase and has been for the last 50 years, except for a brief terminus advance in the mid 1970's. Surface velocities are low.

Publications

Gardner, J.S. and N.K. Jones, 1985. Evidence for a neoglacial advance of the Boundary Glacier, Banff National Park, Alberta. Canadian Journal of Earth Sciences, 22(11), 1753-55

Organization and Address	Tel.No.
Department of Geography, Saint Mary's University, Halifax, Nova Scotia, B3H 3C3	902-420-5739
Department/Branch Geography	**FAX No.** 902-420-5561

Researchers

Norman K. Jones

Project Title	**Status**	
The Sediment Depositional Environment at the Terminus of the Boundary Glacier, Canadian Rockies	**New**	[ ]
	Ongoing	[X]
	Completed	[ ]

Objectives

To describe and explain the entrainment and release of sediment found at the terminus of a small mountain glacier.

Methods

Lab [X] **Field** [X] **Modelling** [ ] **Others**

Findings

Most sediment is transported and released from supraglacial positions creating large medial and lateral noraines. Basal sediment release, although minor creates an interesting suite of glacial bedforms, including glacial flutings.

Publications

Organization and Address	Tel.No.
Department of Geography, Erindale Campus, University of Toronto, Mississauga, Ontario, L5L 1C6	416-828-3929
Department/Branch Geography	**FAX No.** 416-828-5328

Researchers

D. Scott Munro

Project Title	Status	
Energy Exchange Modelling of Ablation and Meltwater Discharge in Glacierized Basins	**New**	[ ]
	Ongoing	[X]
	Completed	[ ]

Objectives

1) Visible and near infrared albedo of ice and snow
2) Long-wave radiation estimation at high altitudes
3) Prediction of seasonal snowline migration

Methods

Lab [ ] **Field** [X] **Modelling** [X] **Others**

Findings

1) Micrometeorological estimates of melting agree with ablation measurements at specific sites.
2) Energy balance modelling of ablation produces realistic glacier mass balance distributions with elevation, but more work is required to improve the accuracy.

Publications

Munro, D.S., 1989. Surface roughness and bulk heat transfer on a glacier: comparison with eddy correlation. Journal of Glaciology, 35(121), 343-348

Munro, D.S., 1990. Comparison of melt energy computations and ablatometer measurements on melting ice and snow. Arctic and Alpine Research, 22(2), 153-162

Organization and Address Karl Ricker (Consultant), 868 11th Street, West Vancouver, British Columbia, V7T 2M2	**Tel.No.** 604-926-5933
Department/Branch	**FAX No.** Telex 04 53143

Researchers

Karl Ricker with British Columbia Mountaineering Club

Project Title **Fluctuations of Snout of Overlord Glacier, Garibaldi Provincial Park, B.C.**	**Status** **New** [ ] **Ongoing** [X] **Completed** [ ]

Objectives

Long-term monitoring of glacier regimen, dating of its moraines

Methods

Lab [ ] **Field** [X] **Modelling** [ ] **Others** Airphot

Findings

Rapid retreat in early- to mid-1800's, readvance ca. 1964 to 1986, static position 1986 to 1989.

Other monitored coastal glaciers will be re-visited as opportunities arise.

Publications

B.C. Mountaineer, 1988 and 1990 editions

Organization and Address Department of Geophysics and Astronomy, Univ. of British Columbia, Vancouver, B.C., V6T 1W5	**Tel.No.** 604-228-2267
Department/Branch Geophysics and Astronomy	**FAX No.** 604-228-6047

Researchers

Jeffrey Schmok and Garry K.C. Clarke

Project Title **Neoglacial Lake Alsek: Sedimentology and Paleohydraulics**	**Status** **New** [ ] **Ongoing** [X] **Completed** [ ]

Objectives

Analyse lake sediments and paleohydraulics of recent ice-dammed lake.

Methods

Lab [X] **Field** [X] **Modelling** [X] **Others** Sedimentology of cores
Markhov chain analysis

Findings

Distinctive facies representing glaciolacustrine, outburst flood, and eutrophic pond depositional environments occur in non-randomly ordered sedimentary sequences.

Publications

Schmok, J.P. and G.K.C. Clarke, 1989. Lacustrine sedimentary record of ice-dammed Neoglacial Lake Alsek. Canadian Journal of Earth Sciences, 26(10), October, 2092-2105

Organization and Address	Tel.No.
Department of Geophysics and Astronomy, Univ. of British Columbia, Vancouver, B.C., V6T 1W5	604-228-2267
Department/Branch Geophysics and Astronomy	**FAX No.** 604-228-6047

Researchers

Jeffrey Schmok and Garry K.C. Clarke

Project Title	Status	
Mass-Balance, Geodetic, and Photographic Surveys of Sentinel, Place and Helm Glaciers, 1989 Balance Year	**New**	[ ]
	Ongoing	[ ]
	Completed	[X]

Objectives

Continue basic glaciological data collection at these glaciers under contract to the National Hydrology Research Institute.

Methods

Lab [ ] **Field** [X] **Modelling** [ ] **Others**

Findings

Mass-balance at all these glaciers was significantly negative in the 1989 balance year. At Sentinel Glacier, the 1966-1989 cumulative mass-balance is +4.4 m, however, the cumulative error appears to be larger than previously suspected.

Publications

Schmok, J., 1990. Mass-Balance, Geodetic, and Photographic Surveys of Sentinel, Place and Helm Glaciers: 1989 Balance Year. Contract No.KW504-9-0062/01-XSB, Department of Geogphysics and Astronomy, University of British Columbia, Vancouver, B.C. for the Physical Hydrology Division, National Hydrology Research Institute, Environment Canada, Saskatoon, Saskatchewan, 29 pp.

Organization and Address Department of Geography, University of Western Ontario, London, Ontario, N6A 5C2	**Tel.No.**
Department/Branch	**FAX No.**

Researchers

Christopher C. Smart

Project Title **Alpine Hydrology**	**Status** **New** [ ] **Ongoing** [X] **Completed** [ ]

Objectives

Methods
Lab [ ] **Field** [ ] **Modelling** [ ] **Others**

Findings

Publications

Organization and Address	Tel.No.
University of Saskatchewan, Saskatoon	306-966-5672
Department/Branch Geography	**FAX No.**

Researchers

Dan Smith

Project Title	Status
The Rae Glacier Project: Glaciological and Hydrological Studies	**New** [X] **Ongoing** [ ] **Completed** [ ]

Objectives

To initiate a scientific survey of glaciological and hydrological activity at Rae Glacier to enable tracing of long-term trends.

Methods

Lab [ ] **Field** [X] **Modelling** [ ] **Others**

Findings

To date, very little attention has been directed to understanding the glaciological behavior of cirgue glacier in western Canada. In fact, most of the glaciological research in this region has focused on continuing studies at a small group of relatively large glaciers. Consequently, a project was formulated to inaugurate field research at a representative cirque glacier site in the summer of 1990.

Publications

Organization and Address Survey Department, B.C. Institute of Technology, 3700 Willingdon, Burnaby, B.C.	**Tel.No.** 604-434-5282
Department/Branch Photogrammetry Division	**FAX No.**

Researchers

Bill Tupper, Karl Ricker and Survey Department staff as required

Project Title **Volumetric Change in Wedgemount Glacier and Monitoring of its Regimen**	**Status** **New** [ ] **Ongoing** [ ] **Completed** [ ]

Objectives

Yearly changes in surface elevation, position of snout and derivation of volumetric change.

Methods

Lab [X] **Field** [X] **Modelling** [ ] **Others**

Findings

Ablation exceeds accumulation almost every year since the project began in the mid-1970s. The lake at its snout has reached its maximum volume because the glacier is no longer submerged in the deep portion of the basin.

Publications

Canadian Alpine Journal 1976 to 1986; future publications on hold.

Organization and Address	Tel.No.
Geophysics Division, Geological Survey of Canada, 1 Observatory Crescent, Ottawa, Ontario, K1A 0Y3	613-995-5515
Department/Branch Energy, Mines and Resources	**FAX No.** 613-952-8987

Researchers

J.R. Weber and R.M. Koerner

Project Title	Status	
Monitoring of Elevation Changes of Arctic Ice Caps	**New**	[X]
	Ongoing	[ ]
	Completed	[ ]

Objectives

To determine elevation changes of the summits of six ice caps in the Canadian Arctic at intervals of 3 to 5 years.

Methods

Lab [ ] **Field** [X] **Modelling** [ ] **Others**

Findings

The project was initiated in May 1990 by measuring the gravity differencebetween Tanquary Fiord and the Agassiz Ice Cap, and between Resolute and the Devon Ice Cap.

Publications

Weber, J.R. and R.M. Koerner, 1989. Monitoring of elevation changes of circumpolar ice caps: a contribution to global change studies. Internal report No.89-8, Geophysics Division, Geological Survey of Canada, Ottawa, Ontario, ** pp.

Organization and Address	Tel.No.
Cold Regions Research Centre, Wilfrid Laurier University, Waterloo, Ontario, N2L 3C5	519-884-1970
Department/Branch	**FAX No.** 519-886-9351

Researchers

G.J. Young

Project Title	Status	
High Mountain Hydrology in a Time of Climate Change	**New**	[ ]
	Ongoing	[X]
	Completed	[ ]

Objectives

To remap several glaciers; compute volumetric change over decades and link this to mountain stream hydrographs.

Methods

Lab [ ] **Field** [X] **Modelling** [X] **Others**

Findings

Peyto Glacier was remapped in 1989, analysis is proceeding.

Publications